

Draft Supplemental Environmental Impact Statement

Steller Sea Lion Protection Measures in the Federal Groundfish Fisheries Off Alaska

Implemented under the Fishery Management Plans for the

Groundfish of the Gulf of Alaska

and the

Groundfish Fishery of the Bering Sea and Aleutian Islands Area

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Abstract: The Gulf of Alaska and Bering Sea Aleutian Islands groundfish fisheries have been managed under fishery management plans since 1978 and 1981, respectively. The range of the Steller sea lion overlaps the waters where the fisheries are conducted. Under the Endangered Species Act, Steller sea lion west of Cape Suckling, Alaska, are listed as endangered; east of Cape Suckling they are listed as threatened. In the core region from the Kenai Peninsula to Kiska Island, counts of adult and juvenile Steller sea lions have declined by about 80% since the population size was estimated in the late 1950s. In 2000, a Biological Opinion prepared under Section 7 of the Endangered Species Act on all aspects of these fisheries concluded that fisheries for pollock, Pacific cod, and Atka mackerel, jeopardize the continued existence of Steller sea lions and adversely modify their critical habitat due to competition for prey and modification of their prey field. The fisheries must be modified and brought into compliance with all federal laws. Several alternative fisheries management proposals have been developed. Changes in management measures vary the degree and direction of impacts the fisheries have on marine mammals, seabirds, prohibited species, target fish species, and the marine habitat. The changes also have impacts on fishers, processors, and coastal communities. Enforcement considerations and management complexity are inextricably tied to regulations. This SEIS evaluates alternatives to mitigate potential adverse effects as a result of competition for fish between Steller sea lions under a no action alternative as well as other alternatives that would substantially reconfigure these fisheries. Impacts are disclosed, both significantly positive and significantly negative as required by the National Environmental Policy Act. A draft biological opinion prepared according to the Endangered Species Act is included for the preferred alternative.

Comments are due by October 15, 2001

Executive Summary

Introduction

The purpose of this draft supplemental environmental impact statement is to: (1) provide information on potential environmental impacts that could occur from implementing a suite of fisheries management measures such that the western population of Steller sea lions existence is not jeopardized nor its critical habitat adversely modified by the groundfish fisheries in the Gulf of Alaska (GOA) and the Bering Sea and Aleutian Islands (BSAI); and (2) meet the National Environmental Policy Act's purpose (40 CFR Section 1500.1) of fostering excellent actions and better decisions that are based on understanding the environmental consequences of actions.

Background

The western population of Steller sea lions declined by over 70% since the 1960s when the population was estimated to be 170,000-180,000 (Braham, 1980; Loughlin *et al.*, 1984; Merrick *et al.*, 1987; Loughlin *et al.*, 1992). Declines were first observed for the eastern Aleutian Islands and they then moved to both the east and west with large reductions throughout the Gulf of Alaska and Aleutian Islands. The western population has been declining steadily at an annual rate of approximately 5% per year during the 1980s and 1990s, with a large increase in the rate of decline in the late 1980s of about 12% per year; the eastern population has been stable or increasing slightly during these two decades. In 2000, the minimum population estimate for the western population of Steller sea lions in Alaska was 34,600 sea lions and the same estimate for the eastern population in Southeast Alaska in 1998 was 15,000 sea lions (Angliss *et al.*, 2001).

The fisheries management measures considered in this draft supplemental environmental impact statement were designed to allow commercial groundfish fishing in the North Pacific while assuring that the fisheries would neither jeopardize the continued existence of both western and eastern Steller sea lion stocks, nor adversely affect their critical habitat. The triggering mechanism for this supplemental environmental impact statement is a series of issues and events involving the Endangered Species Act, the National Environmental Policy Act, the Magnuson-Stevens Act, the Consolidated Appropriations Act of 2001 (Public Law 106-554), the National Marine Fisheries Service (NMFS), the North Pacific Fishery Management Council (the Council), the fishing community, the conservation community, and the U.S. District Court for the Western District of Washington.

A starting point explaining the need for this analysis is the comprehensive Biological Opinion NMFS issued November 30, 2000. The 2000 Biological Opinion concluded that fisheries for walleye pollock, Pacific cod and Atka mackerel being managed under the fisheries regulations in effect in the year 2000, jeopardized the survival and recovery of Steller sea lions and adversely modified their critical habitat. The 2000 Biological Opinion included a reasonable and prudent alternative (RPA) that included, among other things, areas closed to trawling. In December 2000, the North Pacific Fishery Management Council moved to not adopt NMFS's conclusions or RPA in the 2000 Biological Opinion. In order to assure the ongoing federal action (conducting groundfish fisheries) was brought into compliance with the Endangered Species Act, NMFS would have had to implement the RPA by emergency rule for 2001. In response, the Council began a longer term process to consider other measures that could replace the 2000 Biological Opinion RPA and allow fisheries to operate in such a manner that would not jeopardize the continued existence of Steller sea lion and would prevent adverse modification of their critical habitat. In January 2001, legislation was passed (Public Law 106-554)

that required a one-year phase-in of the RPA including application of the global control rule on harvest quotas as well as closure zones. The particulars of all these management measures are fully described in Chapter 2 of this draft supplemental environmental impact statement.

In February 2001 the Council formed an RPA Committee that included members from the fishing community, the conservation community, NMFS, the Council's Scientific and Statistical Committee, and State agencies. NMFS issued an emergency rule to implement Steller sea lion protection measures in the 2001 Alaska groundfish fisheries effective January 20, 2001, to be consistent with the requirements of the Magnuson-Stevens Act, the Endangered Species Act, and additional requirements imposed by Congress in Public Law 106-554. About two weeks later, at its February 2001 meetings the Council sent a letter to the Secretary of Commerce requesting that he use his executive authority to ensure adequate harvest levels are made available for small boats and inshore processors for 2001 fisheries per the mandates of PL 106-554. During that same Council meeting, the Scientific and Statistical Committee concluded that the 2000 Biological Opinion was scientifically deficient, prompting the Council to ask for two reviews. One review would consist of an independent team of four scientists and the other review by the National Academy of Sciences; both reviews are now underway.

The RPA Committee developed a set of alternative fishery management measures to assist the Council in developing alternatives to the 2000 Biological Opinion RPA. By the close of the June 2001 meeting, the Council had agreed to a set of five alternatives for analytical purposes, including the alternative developed by the RPA Committee. Each alternative incorporated a wide variety of changes to existing fisheries management regulations. While these five alternative suites of management measures were considered in detail, three additional alternatives were considered and set aside because the measures they contained were integrated within the alternatives developed. Suggested fisheries management measures include: where closed areas would be set, when areas would be closed, what kinds of fisheries would be closed, how total allowable catch would be established, how total allowable catch would be divided into seasons, how total allowable catch would be divided into various areas, the setting of maximum daily catch limits for certain fisheries, dividing harvest limits between inside and outside critical habitat, the use of spawning biomass in determining allowable biological catch, and dividing fishing vessels into two fleets and assigning a season to each fleet. The five alternatives were developed using a combination of some or all of these management measures. Comparisons of the management measures associated with each alternative are shown in Table ES-1, with definitions of terms and acronyms found in Chapter 2, Section 2.3. Maps showing locations of various management measures for the five alternatives are included as Figures 2.3-1 through 2.3-8 in the map packet. The following is a brief synopsis of each.

- Alternative 1** No action. Regulatory measures implemented by emergency rule, and designed to protect Steller sea lions, would expire. *Note this alternative is presumed to violate the Endangered Species Act.*
- Alternative 2** The low and slow approach. This alternative is derived from the Draft Programmatic SEIS for the Alaska groundfish fisheries (NMFS 2001a). Essentially, the approach is to establish lower total allowable catch levels (TACs) for pollock, Pacific cod, and Atka mackerel, prohibit trawling in critical habitat, and implement measures to spread out catches through the year.

Alternative 3 The restricted and closed area approach. This alternative is the RPA detailed in the November 30, 2000, Biological Opinion. Essential elements of this approach are to establish large areas of critical habitat where fishing for pollock, Pacific cod, and Atka mackerel is prohibited, and to restrict catch levels in remaining critical habitat areas.

Alternative 4 The area and fishery specific approach. This alternative was developed by the Council's RPA Committee. This approach allows for different types of management measures in the three areas (AI, BS, and GOA). Essential measures include fishery specific closed areas around rookeries and haulouts, together with seasons and catch apportionments. Three options for closure areas are examined for this alternative.

Option 1: Chignik small boat exemption.

Option 2: Unalaska small boat exemption.

Option 3: Gear specific zones for GOA Pacific cod fisheries.

Alternative 5 The critical habitat catch limit approach. This alternative is derived from the suite of RPA measures that were in place for the 2000 pollock and Atka mackerel fisheries, and measures considered for the Pacific cod fishery that include seasonal apportionments and harvest limits within critical habitat. Essentially, this alternative limits the amount of catch within critical habitat to be in proportion to estimated fish biomass.

The Preferred Alternative and Biological Opinion

As described in the subsequent Comparison of Alternatives section, NMFS has identified Alternative 4 as the preferred alternative. As part of the NEPA process undertaken following the comprehensive biological opinion and Council rejection of the associated RPA, it was the expectation that if an alternative could be formulated that was found to be in compliance with ESA and other federal laws and Executive Orders, and not be as economically costly as the RPA in the NMFS 2000 Biological Opinion, it would be designated the preferred alternative. Alternative 4 appears to prove that it is possible, thus it is designated the preferred alternative for purposes of this draft environmental impact analysis. Further, NMFS reinitiated Endangered Species Act Section 7 consultation for these fishery management measures, resulting in a Draft 2001 Biological Opinion and Incidental Take Statement (Appendix A). The Draft 2001 Biological Opinion concludes this suite of management measures would not likely jeopardize the continued existence of the western or eastern populations of Steller sea lions, nor would it adversely modify the designated critical habitat of either population. It is important to point out that the Draft 2001 Biological Opinion does not ask if Alternative 4 helps the Steller sea lion population size recover to some specified level so that the species could be delisted, but rather asks if Alternative 4 will jeopardize the Steller sea lion's chances of survival or recovery in the wild. While the Draft Biological Opinion has concluded that Alternative 4 does not jeopardize the continued survival and recovery of Steller sea lions, it none-the-less identified four reasonable and prudent measures to include with Alternative 4 as necessary and appropriate to minimize impacts of the fisheries to Steller sea lions. The measures are: (1) monitoring the take of Steller sea lions incidental to the BSAI and GOA groundfish fisheries; (2) monitoring all groundfish landings; (3) monitoring the location of all groundfish catch to record whether the catch was taken inside critical habitat; and (4) monitoring vessels fishing for groundfish inside areas closed to pollock, Pacific cod and Atka mackerel to see if they are illegally fishing for those species.

Areas of Controversy

No one knows the cause of the decline in the Steller sea lion population, or even knows if the population size estimated in the 1950s and 1960s was at a particularly high level in a long cyclic population trend. Historical accounts from the 1800s can not be relied upon because exaggeration was common to lure people and investments to the Alaskan frontier. Additionally, a vast amount of information is still unknown about the life history of Steller sea lions: details of population structure and population dynamics; mating, breeding and social organization; diet and foraging strategies; and how interspecies and intraspecies competition affects the sea lion. One thing that everyone can agree on, however, is that the Steller sea lion population size has experienced a startling decline over a very short period in this species' long evolutionary history.

While some mortality can be accounted for (i.e., incidental take from fisheries, subsistence harvest), much about the population decline is unexplained. Nutritional stress may be occurring, and if it is, it may be due to competition from fisheries and/or environmental change. Available data are inadequate to evaluate whether nutritional stress is currently affecting Steller sea lion adults or juveniles in the winter. Additional information from weaned pups and juveniles from other seasons and other areas are needed to resolve uncertainties regarding the nutritional stress hypothesis. To date, studies have not linked nutritional stress with the actual decline of numbers.

Much of the effort to explain the Steller sea lion decline has focused on juvenile survival, or has assumed that the most likely proximate explanation is that fewer juveniles are surviving. This assumption is consistent with studies finding low resighting rates of tagged pups, observation of fewer juveniles, and demographic modeling suggesting that the observed decline in sea lion abundance in the GOA may have been due to an increase in juvenile mortality. This is also consistent with the assumption that juvenile animals are less adept at avoiding predators and obtaining sufficient prey for growth and survival. Studies of pup condition of pups up to 6 weeks old have not found evidence of widespread compromise that would result in decreased survivorship, and current studies are therefore focusing on assessing the health and condition of 3 month to 3 year old juveniles. While changes in adult survival may also have contributed to the decline, data are not available to support or reject that hypothesis. Extensive pup tagging and resighting efforts are currently underway to help resolve these issues.

Considerable evidence also exists to suggest that decreased reproductive success may also contribute to the decline. Young females collected in the 1980s were smaller than those of the same age collected in the 1970s and may have been more likely to mature later, thus reducing lifetime pup production and leading to declining populations. Late season pregnancy rates of lactating females in the 1970s were statistically significantly higher (63%) than those found in lactating females collected in the 1980s (30%), suggesting these females were less able to support a fetus.

Differences between recent (1990s) and somewhat historical (1960s) diet studies indicate that the diet of Steller sea lions has shifted. In 1960s studies, their diet was dominated by forage fish such as capelin and herring; studies conducted since the mid-1970s have found a high occurrence of pollock, an increasing importance of Pacific cod in winter, and arrowtooth flounder in the Gulf of Alaska. This shift in diet may have affected the amount of energy available to Steller sea lions. For example, Atka mackerel have generally lower energy density (3 to 6 kilojoules per gram) than fish such as capelin or herring (up to 11 kilojoules per gram) (Anthony et al., 2000). The ramifications of such dietary changes to Steller sea lion nutrition are currently being studied in captive environments. The causes of any shifts in diet are still unknown, with some speculation that climatic and/or environmental variability may be involved.

Finally, numerous sources of mortality may have an effect on Steller sea lion population size. Increased predation on Steller sea lions by killer whales and sharks has also been investigated as a cause of the decline in Steller sea lion population, with one study suggesting that 18% of all sea lion mortality could be attributed to killer whales, though data are lacking to make conclusive estimates. No killer whale population estimates are available for west of Kodiak Island, and only rough estimates exist on the percentage of Steller sea lions in the diet of transient killer whales. Field studies have been initiated in 2001 to provide the information needed to address the issue of whether killer whale predation on sea lions is an important component in causing the current decline. More data are also needed to evaluate the relationship of shark predation on Steller sea lions. As with killer whales, information is needed on how many sharks occur in the range of the western stock of Steller sea lion, the fraction of the sharks' diet that is comprised of Steller sea lions, and the ages and sizes of Steller sea lions that are consumed. Field studies have also been initiated in 2001 to fill data gaps on the effects of shark predation on Steller sea lions. Though there has been an increased effort to instrument Steller sea lions with satellite linked depth recorders, interpretation of these data are still highly uncertain. Even if future studies provide definitive answers to these questions, there will always be uncertainties with estimates of historic groundfish biomass or Steller sea lion population sizes. Techniques for providing unerring foraging data are not in the immediate future, and the cumulative effects of multiple regime shifts are not likely to ever be fully understood.

Understanding whether or not a set of fisheries management measures will result in jeopardy to the Steller sea lion's chance of survival or recovery in the wild hinges on knowing as much as possible of the life history of Steller sea lions. Several issues, including the Steller sea lions reproductive strategy and their feeding strategy, were examined in detail by NMFS in reaching a preliminary no jeopardy decision in the 2001 Draft Biological Opinion. In the process, NMFS asked whether the fisheries management measures were likely to affect the reproduction rate or numbers of Steller sea lions in such a manner that would result in a negative population trajectory due to the effects of those measures. Because much about Steller sea lions is unknown, perhaps even unknowable, much of the 2001 Draft Biological Opinion is based on professional judgement of knowledgeable scientists. Despite substantial research investments currently underway, and no matter how much all interested parties would like to have "hard facts", NMFS's preliminary no jeopardy decision is a qualitative judgment based on the best quantitative and qualitative information currently available.

Precautionary Approach

The precautionary approach was applied in this analysis. Fundamental to understanding the precautionary approach is to accept that all ecosystems are complex and uncertainty is unavoidable. Within uncertainty, there is always a risk of undesirable consequences on fishery resources (e.g., overfishing) and/or on ecosystems. The movement toward application of the precautionary approach was motivated by the widely accepted conclusion of scientists and fishery managers that many of the current problems of fisheries (e.g., a large number of overfished stocks in other areas of the U.S.) have been caused by the practice of making risk-prone fishery management decisions (e.g., to err toward overfishing) in the face of uncertainty. Because the TAC-setting process used in North Pacific groundfish fisheries ensures risk-averse decisions, none of the groundfish stocks in the North Pacific are overfished or subject to overfishing. In this analysis, the precautionary approach was also used in delineating management measures associated with the five alternatives.

Incomplete or Unavailable Information

In this draft supplemental environmental impact statement NMFS uses the term “conditionally significant” to allow informed decision making to proceed in spite of incomplete or unavailable information. When information is incomplete or unavailable to quantify an impact’s significance (positive or negative), or if the point at which an effect becomes significant is not supported by scientific data, the qualifier “conditionally” is applied. The qualifier implies that significance is assumed, based on the credible scientific information and professional judgement that is available, but more complete information is needed for certainty. In other words, the thought may be that an impact has a significant adverse or a significant beneficial effect, but a high level of certainty is not associated with that finding. This approach provides a heightened sense of where information is lacking, and may guide research efforts in the future. An interesting point to make about this approach is that if an impact is rated as insignificant, there is a high level of confidence that the impact is truly insignificant, or it would have been moved to the “unknown” or “conditionally significant” category.

Summary of Environmental Effects of the Alternatives

This draft supplemental environmental impact statement provides a scientific and analytic comparison of the five alternatives, providing significance determinations of the environmental effects of each alternative on all important factors that might be affected by those alternatives. Direct, indirect and cumulative effects are considered. Significance is determined by considering the context in which the action will occur and the intensity of the action. The context in which the action will occur includes the specific resources, ecosystems, and human communities affected. The intensity of the action includes the type of impact (beneficial versus adverse), duration of impact (short versus long), magnitude of impact (minor versus major), and degree of risk (high versus low level of probability of an impact occurring). This supplemental environmental impact statement lists impacts as: significant (positive or negative), conditionally significant (positive or negative), insignificant or unknown. Criteria used for determining significance ratings are explained for each resource. The environmental impacts of the alternatives in comparative form, providing a basis for choice among options, are summarized in Table ES-2. Major conclusions about the direct and indirect effects of each alternative are highlighted below. For each category, questions that analysts asked to predict significance of the effects of an alternative are summarized. The answers to those questions were based on predefined criteria established for this analysis by NMFS’s expertise and understanding of scientific data (or lack of data) for that category. Answers to the significance questions are summarized below, along with corresponding significance criteria. Many of the significance criteria compare an alternative’s effects to annual average rates of that effect recorded between 1997 and 1999 because these three years represent the most recent available data, and the analysts wanted to use more than one year to account for the inherent variability.

Using guidance from the NOAA Administrative Order on implementing NEPA, further tests of intensity were done. These analyses included evaluating: (1) the potential for jeopardizing the sustainability of any target or non-target species; (2) substantial damage to ocean and coastal habitats and or essential fish habitat; (3) impacts on public health or safety; (4) impacts on endangered or threatened species, marine mammals, or critical habitat of these species; (5) cumulative adverse effects; (6) impacts on biodiversity and ecosystem function; (7) significant social or economic impacts; and (8) degree of controversy (NAO 216-6, Section 6.02).

Major conclusions about effects of the alternatives on marine mammals.

Assessing the effects of each alternative on marine mammals was accomplished by analyzing each of seven marine mammal species or species groups separately (Steller sea lions, ESA listed great whales, other

cetaceans, northern fur seals, harbor seals, other pinnipeds, and sea otters) and asking the following questions of each of the five alternatives:

1. What effect does the alternative have on direct interactions with marine mammals (incidental take and entanglement in marine debris)?
2. How much effect does the alternative have on harvests of prey species of particular importance to marine mammals?
3. How much effect does the alternative have on the temporal or spatial concentration of fishing effort in areas used for foraging by marine mammals?
4. How much effect does the alternative have on modifying marine mammal or prey behavior?

Analyses were done for the marine mammal groups at the population level. The environmental baseline selected for use in comparing alternatives were the management measures in place through the end of 1998 for pollock and Pacific cod and through 2000 for Atka mackerel.

The effects of incidental catch and entanglement in marine debris was found to be insignificant under all alternatives for all marine mammals, except for killer whales where the effects are unknown. This is because the numbers of incidental takes and incidence of entanglement are at very low levels unlikely to affect marine mammals at the population level, and while reductions are desirable, even a rate of zero would not be significant at the population levels.

With respect to harvest levels of prey species, Alternatives 1, 4, and 5 which would alter TAC levels (and presumably harvest levels) the least, the anticipated effects were rated as conditionally significant negative for Steller sea lions, northern fur seals, and harbor seals (Alternatives 1 and 4 only) and as insignificant for other marine mammal groups. Alternative 2, which would reduce TAC levels the most and substantially lower the amount of pollock, Pacific cod, and Atka mackerel which could be taken in Steller sea lion critical habitat was rated as conditionally significant positive for Steller sea lions, humpback whales, and harbor seals, conditionally significant negative for northern fur seals, and insignificant for other marine mammals. Alternative 3, which would substantially reduce the harvest of prey species within Steller sea lion critical habitat was rated as conditionally significant positive for humpback whales, conditionally significant negative for northern fur seals, and insignificant for other marine mammals. Alternative 5 was rated conditionally significant negative for Steller sea lions and northern fur seals and insignificant for other marine mammals.

With respect to the temporal and spatial concentration of the fisheries, Alternative 1 was rated as conditionally significant negative for Steller sea lions, northern fur seals, and harbor seals, and insignificant for other marine mammals. Alternative 2 was rated conditional significant positive for Steller sea lions and harbor seals, conditionally significant negative for northern fur seals, and insignificant for other marine mammals. Alternative 3 was rated conditional significant positive for Steller sea lions, conditionally significant negative for northern fur seals and harbor seals, and insignificant for other marine mammals. Alternatives 4 and 5 were rated conditionally significant negative for northern fur seals and harbor seals, and insignificant for other marine mammals.

Disturbance effects were rated as insignificant under all alternatives except for northern fur seals which are unknown.

Although many of the effects were rated as insignificant, this does not mean that the management measures contained in the alternatives would not have some beneficial impacts on local marine mammal populations.

However these beneficial impacts on local populations could be offset by displacing fishing activities into other areas, and at a meta-population level are not expected to have a significant effect on marine mammal population trajectories. Management measures included in the alternatives were not analyzed with respect to the development of an experimental design to evaluate the efficacy of Steller sea lion protection measures. Alternatives 3 and 4, to a greater extent than the other alternatives, do contain management measures which could be useful in the development of such an experimental design.

Major conclusions about effects of the alternatives on target commercial fish species.

Assessing the effects of each alternative on target commercial fish species was accomplished by analyzing each of nine species or species groups separately (walleye pollock, Pacific cod, Atka mackerel, flatfish, Bering Sea/Aleutian Islands rockfish, Gulf of Alaska rockfish, thornyheads, sablefish and other species) and asking the following questions of each of the five alternatives:

1. How much effect does the alternative have on fishing mortality?
2. How much effect does the alternative have on spatial or temporal concentration of the species?
3. How much effect does the alternative have on the availability of prey for the target species?
4. How much effect does the alternative have on the target species' habitat?

Analyses were done separately for the Bering Sea/Aleutian Islands and the Gulf of Alaska. For walleye pollock and Pacific cod, effects from all five alternatives are predicted to be insignificant because they meet the following significance criteria: (1) they would not be expected to jeopardize the capacity of the stock to produce maximum sustainable yield on a continuing basis; (2) they would not alter the genetic sub-population structure such that it jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold; (3) they would not alter harvest levels such that it jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold; (4) they would not alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold; and (5) they would not disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold.

For Atka mackerel, flatfish, rockfish, thornyheads, sablefish and other species analyzed, the effects from all alternatives are predicted to be either insignificant or unknown.

Major conclusions about effects of the alternatives on incidental catch of non-specified species.

Assessing the effects of each alternative on incidental catch of non-specified species was accomplished by analyzing five non-specified species or groups of species: (grenadiers, other non-specified fish, jellyfish, sessile invertebrates, and mobile invertebrates). Only one question was asked: Would each alternative induce a different level of non-specified species bycatch as compared to average levels of bycatch between 1997 to 1999?

Analyses were done separately for the Bering Sea/Aleutian Islands and the Gulf of Alaska. For Alternatives 1, 4, and 5 in the Bering Sea/Aleutian Islands, effects are predicted to be insignificant (less than 20% change) or unknown; for Alternatives 2 (low and slow) and 3 (restricted and closed areas) effects are predicted to induce conditionally significant positive effects (20 to 50% reduction) on jellyfish bycatch. In the Gulf of Alaska, jellyfish bycatch is predicted to result in a significant positive impact (greater than 50% reduction)

from Alternative 2 and a conditionally significant positive impact from Alternative 3. Other non-specified fish, sessile invertebrates and mobile invertebrates are predicted to receive conditionally significant positive effects from Alternative 2.

Major conclusions about effects of the alternatives on forage fish.

Assessing the effects of each alternative on forage fish was accomplished by analyzing one species of forage fish, and combining all other forage fish in one category (smelt and other forage fish). Only one question was asked: Would each alternative induce a different level of incidental catch of the forage fish relative to the average 1997 to 1999 incidental catch of forage fish?

Analyses were done separately for the Bering Sea/Aleutian Islands and the Gulf of Alaska. For all alternatives, effects are predicted to be insignificant (less than 20% change), except smelt bycatch is predicted to have conditionally significant positive effects (between 20% and 50% reduction) from Alternative 2 (low and slow) in both the Bering Sea/Aleutian Islands and the Gulf of Alaska, and significant positive effects (greater than 50% reduction) from Alternative 3 (restricted and closed areas) in the Gulf of Alaska.

Major conclusions about effects of the alternatives on prohibited species bycatch.

Assessing the effects of each alternative on prohibited species bycatch was accomplished by analyzing eight species or groups of species of bycatch (halibut, herring, Chinook salmon, other salmon, Tanner crab, snow crab, red king crab, and other king crab) for the walleye pollock and Pacific cod fisheries in the Bering Sea/Aleutian Islands and Gulf of Alaska, and the Atka mackerel fishery in the Aleutian Islands. The following questions were asked of each of the five alternatives:

1. How much change does the alternative have on bycatch relative to the average 1997-1999 bycatch?
2. How much change does the alternative make in spatial and/or temporal concentration of the bycatch relative to the average 1997-1999 bycatch?
3. How much change does the alternative have on biomass removal of prey by fisheries relative to average 1997-1999 data?

Analyses were done separately for the Bering Sea/Aleutian Islands and the Gulf of Alaska. In the Bering Sea, all alternatives are predicted to have insignificant effects (less than 50% reduction or no change in spatial/temporal concentration) for all species and issues, except for Alternative 2 (low and slow). Alternative 2 is predicted to induce conditionally significant positive effects (50% to 99 reduction) on Chinook salmon and other salmon bycatch, but would induce conditionally significant negative effects (50% to 99% increase) on the bycatch of herring and king crabs other than red king crab. In the Aleutian Islands, insignificant effects are predicted except for the following cases: (1) Chinook salmon are predicted to receive conditionally significant positive effects from all alternatives except Alternative 3 (restricted and closed areas), where conditionally significant negative effects are predicted; (2) herring are predicted to receive conditionally significant positive effects from Alternatives 2 and 3; and (3) other Tanner crab are predicted to have conditionally significant positive effects from Alternatives 2,3, and 4. For all alternatives in the Gulf of Alaska, and for all species and effects parameters, the effects are predicted to be insignificant.

Major conclusions about effects of the alternatives on Endangered Species Act listed Pacific salmon.

Assessing the effects of each alternative on Endangered Species Act listed Pacific salmon was accomplished by asking the following questions of each of the five alternatives:

1. How much change does the alternative make in bycatch of Pacific salmon relative to the 1997-1999 bycatch?
2. How much change does the alternative have on spatial and/or temporal concentration of the bycatch of Pacific salmon relative to the 1997-1999 bycatch?
3. How much change does the alternative have on biomass removal of prey relative to 1997-1999 data?

Analyses were done separately for the Bering Sea/Aleutian Islands and the Gulf of Alaska. All alternatives are predicted to have insignificant effects (less than 50% reduction in bycatch, no change in spatial/temporal concentration and no substantial difference in prey biomass removal), except for Alternative 2 (low and slow). Alternative 2 is predicted to induce conditionally significant positive effects on Pacific salmon bycatch (50% to 99% reduction) in both the Bering Sea/Aleutian Islands and the Gulf of Alaska. These results are thought to be below a level at which Endangered Species Act consultation should be reinitiated.

Major conclusions about effects of the alternatives on seabirds.

Assessing the effects of each alternative on seabirds was accomplished by analyzing each of six species or species groups separately (northern fulmar, short-tailed albatross, other albatrosses and shearwaters, piscivorous seabirds, elders, and other seabirds) and asking the following questions of each of the five alternatives:

1. How much effect does the alternative have on incidental take?
2. How much effect does the alternative have on prey availability?
3. How much effect does the alternative have on benthic habitat?
4. How much effect does the alternative have on processing waste and offal?

Analyses were completed by combining the Bering Sea/Aleutian Islands and the Gulf of Alaska. All alternatives are predicted to have unknown or insignificant effects (take number and/or rate is the same as 1993-1999 averages, prey availability is the same, impact to benthic habitat is the same, and availability of processing wastes is the same [all are qualitative estimates]) except for the following predictions: (1) a conditionally significant positive effect is predicted for the availability of processing wastes (wastes may be minimally increased) for the northern fulmar for all alternatives except Alternative 2 (low and slow), which is predicted to have an insignificant effect; and (2) all alternatives are predicted to induce a conditionally significant negative effect on incidental take for the short-tailed albatross (take number and/or rate may increase minimally).

Major conclusions about effects of the alternatives on marine habitat and other essential fish habitat.

Assessing the effects of each alternative on marine habitat and other essential fish habitat was accomplished by asking the following questions of each of the five alternatives:

1. How much removal and damage to biota which forms living substrate will occur from trawl gear associated with the alternative?

2. How much removal and damage to biota which forms living substrate will occur from fixed gear associated with the alternative?
3. How much modification does trawling cause to non-living substrate and/or how much damage to small epifauna and infauna?
4. How much modification does fixed gear have on non-living substrate and/or damage to small epifauna and infauna?
5. How much change to species diversity does the alternative effect as measured by the area of trawling closure?

Analyses were completed by combining the Bering Sea/Aleutian Islands and the Gulf of Alaska. Alternatives 1 (no action) and 5 (critical habitat catch limits) are predicted to cause conditionally significant negative effects (moderate displacement in trawling effort) for all questions except for the question of modification to habitat by fixed gear, where all alternatives are predicted to have insignificant effects (no change in fixed gear efforts). Alternative 2 (low and slow) is predicted to cause significant positive effects on removal of biota which forms living substrate by trawling (greater than 100% increase in closed areas without displacement of effort elsewhere) and conditionally significant positive effects on removal of biota in habitat areas of concern by fixed gear (some increase in areas closed), modification to substrate by trawling (areas closed to trawling is greater) and changes to species diversity (area closed to trawl is greater). Alternative 3 (restricted and closed areas) is predicted to induce conditionally significant positive effects for the trawling questions (area closed to trawling is moderately greater), and insignificant effects for the fixed gear questions. Alternative 4 (area and fishery specific) is predicted to have conditionally significant negative effects (moderate displacement of trawling effort), except that insignificant impacts are predicted for bottom substrate from fixed gear.

Effects on essential fish habitat (EFH) were evaluated for each alternative. All of the alternatives have the potential for regional adverse effects to EFH, or to a component of EFH such as certain biota known as habitat areas of particular concern (HAPC). Consultations on essential fish habitat will be completed as appropriate.

Major conclusions about effects of the alternatives on the ecosystem.

Assessing the effects of each alternative on the ecosystem was accomplished by asking the following questions of each of the five alternatives:

1. How are predator-prey relationships affected by the alternative?
2. How is energy flow and balance affected by the alternative?
3. How is biological diversity affected by the alternative?

Analyses were completed by combining the Bering Sea/Aleutian Islands and the Gulf of Alaska. Predatory-prey relationships were assessed with four indicators: pelagic forage availability, spatial/temporal concentration of fishery on forage, removal of top predators, and introduction of nonnative species. All alternatives were predicted to induce significantly positive effects when considering pelagic forage availability (greater than 10% increase in pollock or other key forage abundance). While Alternative 1 (no action) is predicted to have conditionally significant negative effects on spatial/temporal concentrations of fishery on forage (probable increased temporal or spatial compression), all other alternatives would have conditionally significant positive effects (probable decreased temporal or spatial compression). All alternatives are predicted to induce insignificant effects on removal of top predators (no change in trophic

level of catch relative to trophic level of biomass). All alternatives are predicted to induce insignificant effects on the introduction of nonnative species (less than 10% change in total catch), except Alternative 1 where conditionally significant negative effects are predicted (greater than 10% increase in total catch).

Energy flow and balance is predicted to have insignificant effects from all five alternatives, as is functional diversity under biological diversity. Conditionally significant positive effects on species diversity is anticipated for Alternatives 2 through 5.

Major conclusions about effects of the alternatives on State of Alaska managed fisheries.

Assessing the effects of each alternative on State of Alaska managed fisheries was accomplished by analyzing five state managed waters (Prince William Sound, Cook Inlet, Kodiak, Chignik, and South Peninsula) and asking if each alternative would have an effect on the harvest levels of state managed Pacific cod fisheries and Prince William Sound pollock fisheries, and the parallel Pacific cod fisheries that occur within state waters during the open federal season.

Alternative 1 (no action) is predicted to induce insignificant effects (less than 20% change in catch) in all state waters examined. Alternative 2 (low and slow) is predicted to induce significant adverse effects (greater than 50% decrease in harvest) in all state managed fisheries examined. Alternative 3 (restricted and closed areas) is predicted to induce significant negative effects on Prince William Sound, Kodiak and South Peninsula state managed fisheries, and conditionally significant negative effects (between 20% and 50% decrease in harvest) on Cook Inlet and Chignik state managed fisheries. Alternative 4 (area and fishery specific) is predicted to induce insignificant effects in all state waters examined, except Chignik, where significant negative effects are predicted unless a Chignik small boat exemption (Option 1 under this alternative) is implemented, whereby conditionally significant negative effects are predicted. Alternative 5 (critical habitat catch limits) is predicted to have insignificant effects on Prince William Sound, but significant negative effects on Cook Inlet, Kodiak, Chignik and South Peninsula state managed fisheries.

Major conclusions about effects of the alternatives on management and enforcement.

Assessing the effects of each alternative on management complexity and enforcement considerations was accomplished by asking if each alternative would have an effect on: (1) monitoring and enforcing compliance with area closures; or (2) managing harvest within specified catch limits.

All alternatives are predicted to have significant negative effects on monitoring and enforcement (complex area boundaries are created and the number of directed fishing closures is increased), with Alternative 4 (area and fishery specific) being the most complex alternative. While Alternative 1 (no action) is predicted to induce insignificant effects on managing harvest within specified limits (no change in the number of quota categories or the size of quotas), all other alternatives are predicted to have significant negative effects on managing harvest within specified limits (an increase in the number of quota categories and a decrease in the amount of catch available in the quota categories), with Alternative 2 (low and slow) being the most complex alternative. The Regulatory Impact Review (Appendix C) states that NMFS Division of Enforcement estimates costs of approximately \$552,000 per year associated with Alternatives 2 through 5 and NMFS Sustainable Fisheries Division estimates costs of \$300,000 per year for Alternatives 2, 3, and 5 and \$400,000 per year for Alternative 4.

Major conclusions about effects of the alternatives on the socioeconomic environment.

The socioeconomic effects of implementing Steller sea lion protection measures were assessed for the federally managed commercial pollock, Pacific cod and Atka mackerel fisheries in terms of 21 socioeconomic indicators by region. The following summary includes comparisons of Alternatives 2 and 4 with Alternative 1 for four of these indicators, vessel safety and the non-market values of Steller sea lions and other living marine resources. These alternatives were selected for the summary comparisons because Alternative 1 is the no action alternative and because compared to Alternative 1, Alternatives 2 and 4, respectively, are projected to have the largest and smallest effects on the four indicators.

The comparisons are for the following seven regions:

1. Alaska Peninsula/Aleutian Islands,
2. Kodiak,
3. Alaska Southcentral,
4. Alaska Southeast,
5. Washington Inland Waters,
6. Oregon Coast, and
7. All regions combined, including all other regions.

The four socioeconomic indicators used in this summary for the pollock, Pacific cod and Atka mackerel fisheries are as follows:

1. Catcher vessel harvest by region of vessel owner. This provides a gross indication of direct participation by regional residents in the harvest sector.
2. The ex-vessel value paid by shorebased processors in the region. This figure provides a good indication of the relative value of the relevant groundfish species coming ashore in the region, and provides a good indicator of the level and changes in level of the local fisheries related tax base.
3. The harvesting and processing payments to labor accruing to the region. This indicator illustrates the value of the fishery employment to the residents of the region.
4. The harvesting and processing employment accruing to the region. This indicator provides a means to track changes in the total groundfish fisheries employment in the region.

The summary comparisons (shown in Table ES-3) are made for the high and low estimates for these four indicators and three alternatives. The high estimates are based on the assumption that all of the available total allowable catch of pollock, Pacific cod and Atka mackerel is harvested, including portions of the total allowable catch that are put at risk by these alternatives. The high estimate in this sense represents a “best-case” scenario for each alternative with respect to total catch. It should be noted that even if all of the catch is harvested, other “normal” factors could affect the outcome including market conditions, unanticipated bycatch closures or lower than anticipated catch rates. Thus it is unlikely that even under the best conditions, the high estimate will actually be attained. The low estimate is based on the assumption that none of the portions of the total allowable catch that are put at risk by these alternatives are harvested. Because fishers have shown a great deal of adaptability in the past, it is unlikely that the harvest and processing levels associated with the low estimate will occur. It is more likely that the actual outcome will fall somewhere between the high estimate and the low estimate. However, the low estimate may not necessarily represent a “worst case” scenario, because other outside factors could influence the outcome. These outside factors include market conditions and catch rates in traditional fishing areas, among others, and could conceivably combine to result in outcomes that are worse than the low estimate.

The estimates of the decreases in ex-vessel value and payments to labor, with Alternatives 2 and 4 compared to Alternative 1, do not account for the ex-vessel and product price increases that probably would occur as the result of decreased catch. This source of an upward bias in these estimates is offset to an unknown extent by the failure to fully account for the decreases in ex-vessel and product values per unit of catch that probably would occur due to the additional Steller sea lion restrictions which prevent fishermen from fishing at their preferred times and locations. The information required to adjust ex-vessel and product prices for either the predicted changes in catch or the expected decreases in value per unit of catch is not available. The same is true for the information required to estimate the increases in harvesting and processing costs that would occur per unit of catch due to those additional restrictions.

When Alternative 2 is compared to Alternative 1 for all regions and the three species combined, the following reductions are predicted:

- Harvest by catcher vessel -- 343,000 to 615,000 tons (31% to 55%)
- Ex-vessel value paid by shorebased processors -- \$88 million to \$149 million (36% to 61%)
- Harvesting and processing payments to labor -- \$185 million to \$309 million (28% to 47%)
- Harvesting and processing employment (FTEs) -- 2,900 to 4,700 (29% to 48%)

The same types of comparisons between Alternatives 4 and 1 yield the following predicted reductions:

- Harvest by catcher vessel -- 51,000 to 100,000 tons (5% to 9%)
- Ex-vessel value paid by shorebased processors -- \$2.6 million to \$14.4 million (1% to 6%)
- Harvesting and processing payments to labor -- \$7.1 million to \$33 million (1% to 5%)
- Harvesting and processing employment (FTEs) -- 34 to 513 (0% to 5%).

Both Alternatives 2 and 4 may cause disproportionate socioeconomic effects on some regions. For example, Alternative 2 is predicted to cause between 31% and 55% reductions in catcher vessel total harvests of pollock, Pacific cod and Atka mackerel across all regions, but is predicted to cause between 54% and 80% reductions in regionally owned catcher vessel harvests in the Alaska Peninsula/Aleutian Island region. The decreases in total harvesting and processing payments to labor and employment accruing to this region from the pollock, Pacific cod and Atka mackerel fisheries are also disproportionately large. For the Kodiak region, the predicted decrease is disproportionately large for each of the four indicators.

Alternative 4 is predicted to cause 5% to 9% reductions in catcher vessel harvest of pollock, Pacific cod and Atka mackerel across all regions, but is predicted to cause 7% to 17% and 9% to 15% reductions in regionally owned catcher vessel harvest in the Alaska Peninsula/Aleutian Island and Oregon Coast regions, respectively. Likewise, across all regions, Alternative 4 is predicted to cause reductions in total ex-vessel value of pollock, Pacific cod and Atka mackerel of between 1% and 6%, but the Kodiak region is predicted to lose between 3% and 12%.

Finally, it should be pointed out that specific fisheries within specific regions may experience disproportionate impacts relative to the total fishery in that region. For example, under Alternative 4, a disproportionate impact can be seen in the Alaska Peninsula/Aleutian Island, where harvest reductions to regional owned catcher vessels are predicted to drop between 7% and 17%, but the Pacific cod harvest is predicted to drop between 17% and 26%. Other disproportionate fisheries specific impacts can be found by examining the data tables in Chapter 4, Section 12 of this Draft Supplemental Environmental Impact Statement.

The National Institute of Occupational Health and Safety estimated the occupational fatality rate in the commercial groundfish fishery off Alaska was about 10 times the national average of 4.4 per 100,000 employees for all occupations combined for 1991 to 1998. The potential of an alternative to increase the risk of accidents and injury compared to Alternative 1 was assessed. Alternative 2 is predicted to have the largest operational changes (e.g., transit greater distances between port and open fishing grounds, fish farther offshore, and aggravate the race for fish). Therefore, Alternative 2 is expected to have a high potential to increase the risk of accidents and injury per unit of catch. However, this adverse effect will be offset, at least in part, by the substantial reductions in catch that would occur with this alternative. Alternative 4 reduces some requirements which force effort farther offshore (especially for the smaller vessels) and should, therefore, impose a relatively lower risk of accident and injury, to the extent that occurrence of accidents and injuries are highly correlated with fishing distance offshore, weather and sea conditions, and vessel size.

The socioeconomic effects of implementing Steller sea lion protection measures also were assessed in terms of non-market values. These include the subsistence use, non-consumptive use and existence values of living marine resources.

Given the lack of availability of precise information, it is not possible to distinguish degrees of positive subsistence impact among the alternatives, either to order them or to determine whether or not such theoretically positive impacts would rise to a level of significance. Logically, those which reduce commercial groundfish harvest the most would have the most potential benefit for the subsistence use of Steller sea lions and other living marine resources. Therefore, Alternatives 2 and 4 would be expected to provide increased subsistence use values compared to Alternative 1.

Although the other non-market values of Steller sea lions and other living marine resources are thought to be substantial, the difference in these values among the alternatives is not known. That uncertainty is due, in part, to our limited ability to predict the degree to which the various alternatives affect the probability of either the recovery or extinction of Steller sea lions. However, as with subsistence value, the other non-market values would be expected to be higher for alternatives that decrease the probability of extinction or increase the probability of recovery.

Cumulative effects

An analysis of cumulative effects was conducted to address the additive effects of past, present, and future actions on the Steller sea lions and groundfish fisheries. Such actions can include those of the National Marine Fisheries Service (NMFS), other human controlled events and natural events. The NMFS actions encompass past, present, and future actions associated with groundfish fisheries. Human controlled events include other fisheries (direct catch, bycatch, and direct and indirect mortality from foreign, joint venture, State of Alaska and international halibut fisheries, commercial hunting and harvesting as applied to marine mammals, and subsistence harvests); and anthropogenic causes such as pollution, oil and gas activities, logging, creation of infrastructure such as ports and harbors, commercial shipping effects, harassment, and introduced mammals. Natural events (or phenomena) include climate effects - long and short term remotely forced sea surface temperature anomalies, and interdecadal climactic changes (regime shift); life cycle effects - winter mortality and disease; and trophic interactions - predation, competition and changes in community structure.

Cumulative effects were examined for marine mammals (including the Steller sea lion), target groundfish species (including the pollock, Pacific cod, and Atka mackerel) and other species, non-specified fish species,

forage fish, prohibited species, ESA listed Pacific salmon, seabirds, benthic habitat and essential fish habitat, the ecosystem, and socioeconomic indicators. For each of these topics, specific factors were utilized to reflect the direct and indirect effects of the five alternatives analyzed herein, along with other pertinent past, present, and future actions. For example, the direct effects of the alternatives on all target groundfish species include fishing mortality and the spatial/temporal concentration of the catch. Indirect effects include prey availability and habitat suitability. More specifically, the direct effects of the alternatives on the Steller sea lion include incidental take or entanglement, and effects on abundance of prey; while the indirect effects include spatial and temporal harvest of prey, and disturbance. In each case, relevant other actions were also addressed. To achieve consistency in the identification and evaluation of cumulative effects, defined rating criteria and associated scales were utilized.

The results of the analysis will be summarized regarding the Steller sea lion, three target groundfish species (pollock, Pacific cod, and Atka mackerel), and socioeconomic indicators.

For the Steller sea lion:

- (1) Cumulative effects were identified for all five alternatives regarding incidental take or entanglement, prey availability, spatial and temporal harvest of prey, and disturbance.
- (2) Cumulative effects for incidental take or entanglement and disturbance, were not considered to be conditionally significant.
- (3) Cumulative effects for prey availability were considered to be conditionally significant in a negative manner for all five alternatives; further, cumulative effects for spatial and temporal harvest of prey were identified as negatively conditionally significant for four of the five alternatives (only Alternative 2 was noted as not conditionally significant).

For the three target groundfish species and all five alternatives:

- (1) Cumulative effects were identified for fishing mortality, habitat suitability, and prey availability for pollock and Pacific cod in the eastern Bering Sea and Aleutian Islands (BSAI), and the Gulf of Alaska (GOA); however, none were considered to be conditionally significant adverse cumulative effects.
- (2) Cumulative effects were identified for habitat suitability and prey availability for Atka mackerel in BSAI; however, they were not considered to be conditionally significant in a negative context.
- (3) Cumulative effects were noted for fishing mortality, spatial and temporal concentration, habitat suitability, and prey availability for Atka mackerel in the GOA; however, the significance of each of these effects is unknown at this time.

Cumulative socioeconomic effects for the five alternatives were examined in relation to 12 selected factors as follows: (1) *existence values* - value placed by society on the existence and stability of Steller sea lion populations; (2) *non-market subsistence values* - value of Steller sea lions as a subsistence resource to Alaska Natives; (3) *non-consumptive eco-tourism use* - value of Steller sea lion as a wildlife resource for eco-tourism; (4) *harvests and fish prices* - projected harvest levels and fish prices, including uncertainty regarding the ability to harvest total allowable catch (TAC) in new areas outside critical habitat closed to fishing (harvest considered at risk); (5) *operating cost impacts* - variable and fixed operating costs for harvesting and processing sectors, including costs associated with learning new fishing grounds; (6) *groundfish product values* - market value of various processed groundfish products; (7) *safety impacts* - effects on vessel operating safety due to “race for fish”, and vessel size/need to fish further offshore; (8) *impacts on related*

fisheries - increases in non-target catch of cod and pollock, and transfer of fishing effort to other target groundfish fisheries; (9) *costs to consumers* - potential market impacts from reductions in harvest of pollock, Pacific cod, and Atka mackerel; (10) *management and enforcement costs* - costs associated with managing, monitoring and enforcing changes in areas open and closed to transit and harvest, based on critical habitat and gear type; (11) *excess capacity* - effects on harvesting and processing capacity due to changes in level and location of target groundfish harvests; and (12) *prohibited species bycatch and discards* - changes in levels of unintentional bycatch and discard volumes associated with changes in harvest areas and seasons.

For the 12 socioeconomic factors:

- (1) Cumulative effects were identified for all 12 factors for Alternatives 1, 4, and 5; 10 of the 12 factors had cumulative effects for Alternatives 2 and 3 (the exceptions were listed as “unknown cumulative effects” for impacts on related fisheries and prohibited species bycatch and discards).
- (2) Conditionally significant negative cumulative effects were noted for Alternative 1 relative to existence benefits, non-consumptive eco-tourism, and excess capacity; for Alternatives 2 and 3 relative to harvests and fish prices, product quality and revenue impacts, operating costs impacts, safety impacts, costs to consumers, management and enforcement costs, and excess capacity; for Alternative 4 relative to operating cost impacts, and excess capacity; and for Alternative 5 relative to harvest and fish prices, operating cost impacts, and excess capacity.
- (3) The significance of the cumulative effects were listed as unknown at this time for Alternative 1 for non-market subsistence use; and for all five alternatives for impacts on related fisheries, and prohibited species bycatch and discards.

In summary regarding the cumulative effects analysis, it should be noted that this type of analysis is a new addition to NEPA documents, particularly for fisheries management actions. Accordingly, established methodologies based on professional practice are extremely limited. Nonetheless, the analysis presented herein, albeit qualitative in nature, was accomplished in a systematic and consistent manner. Numerous cumulative effects were identified, and in the majority of cases they were determined to be insignificant. In a few cases, the significance of the cumulative effects were deemed unknown based on the absence of quantitative information. Accordingly, no identified cumulative effects related to the Steller sea lion, the three target groundfish species, or socioeconomic indicators are perceived to have such negative consequences that Alternative 4 should be eliminated as a viable option.

Comparison of the Alternatives

A summary comparison of the five alternatives is based on information found in Tables ES-2 and ES-3, and the above discussion of cumulative effects. The first four summary comments below reflect a trade-off analysis (comparison of the differences of each alternative relative to each effect parameter for the resources, species, or species groups) of the information in Table ES-2.

1. No trade-offs (differences) are shown for the effects of Alternatives 1 through 5 on four marine mammals (unlisted cetaceans, northern fur seals, other pinnipeds, and sea otters), on all 11 target commercial fish species (pollock, Pacific cod, Atka mackerel, flatfish, other flatfish, Pacific Ocean perch, red rockfish and other rockfish, thornyheads, sablefish, and squid and other species), on one prohibited species bycatch (in GOA), on five seabirds (short-tailed albatross, other albatrosses and shearwaters, piscivorous seabirds, eiders, and other seabird species), and one of three components of ecosystems (energy flow and balance).

2. Some trade-offs (differences) are shown for the effects of Alternatives 1 through 5 on resources, species, species groups, or effect parameters that are not central issues in this specific decision process related to the RPA for the Steller sea lion. Further, the actual effects shown range from U to CS- to I to CS+. The issues in this category include Endangered Species Act (ESA) listed cetaceans, harbor seals, non-specified fish species, forage fish, prohibited species bycatch in the Bering Sea (pollock and Pacific cod), prohibited species bycatch in the Aleutian Islands (Atka mackerel), ESA listed Pacific salmon, Northern fulmar, and marine benthic habitat and other essential fish habitat.
3. Some trade-offs (differences) are shown for the effects of Alternatives 1 through 5 on four resources, species, species groups, or effect parameters that are central issues in this decision process (Steller sea lions, predator-prey relationships, diversity, and economic indicators). It should be recognized that effects on pollock, Pacific cod, and Atka mackerel also influence Steller sea lions; however, as noted above, all five alternatives are depicted as having insignificant (I) effects on these target commercial fish species.
4. To further refine the trade-off analysis, Alternative 1 can be set aside as a viable option due to its potential noncompliance with RPA requirements to adequately address “jeopardy and adverse modification” for Steller sea lions. Alternatives 3 and 5 can be set-aside in this final analysis due to lesser interest in these options by the Council and general public. Re-examination of the trade-offs between Alternatives 2 and 4 in relation to the four issues listed in (3) above reveal that there are no trade-offs (differences between these two alternatives) for predator-prey relationships and diversity. Examination of the remaining effects parameters for Steller sea lions and economic indicators reveal that trade-offs are displayed for only four parameters (harvest of prey species and spatial/temporal concentration of fishery for the Steller sea lion; and the economic indicators listed as harvests and fish prices, and costs to consumers).
5. Three additional considerations in the trade-off analysis between Alternatives 2 and 4 are: (1) compliance with ESA requirements to adequately address “jeopardy and adverse modification” for the Steller sea lion; (2) cumulative effects comparisons; and (3) specific socio-economic data as contained in Table ES-3. Based upon these considerations in conjunction with the trade-offs displayed in Table ES-2, the following summary features of Alternatives 2 and 4 can be listed:

Alternative 2

- conditionally significant positive effects would occur on the harvest of prey species and the spatial/temporal concentration of the fisheries; as a result, it is presumed that a “no jeopardy and no adverse modification” opinion would be rendered by the NMFS for the Steller sea lions
- significant negative effects would occur on harvest and fish prices for target groundfish species
- conditionally significant negative effects would occur in relation to costs to consumers
- the four socio-economic comparisons shown in Table ES-3 depict overall losses of between 28 to 61 percent, further, the losses are not evenly distributed based on the analysis of six geographical regions (the losses range from 23 to 80 percent depending upon the comparison and region)
- conditionally significant negative cumulative effects would occur for prey availability for the Steller sea lion; and likewise for harvests and fish prices, product quality and revenue impacts, operating cost impacts, safety impacts, costs to consumers, management and enforcement costs, and excess capacity

Alternative 4

- conditionally significant negative effects would occur on the harvest of prey species for the Steller sea lion, and insignificant effects would occur on the spatial/temporal concentration of the fisheries; a “no jeopardy and adverse modification” opinion has been obtained from the NMFS (see 2001 Draft Biological Opinion and Incidental Take Statement in Appendix A), and four reasonable and prudent measures have been identified as monitoring requirements to document the effectiveness of Alternative 4 in this regard
 - insignificant effects would occur on harvest and fish prices for target groundfish species, and in relation to costs to consumers
 - the four socio-economic comparisons shown in Table ES-3 depict losses of between less than 1% to 6%, further, the losses are not evenly distributed based upon the analysis of six geographical regions (the losses range from zero to 17 percent depending upon the comparison and region)
 - conditionally significant negative cumulative effects would occur for prey availability for the Steller sea lion and the spatial and temporal harvest of prey; likewise, such negative effects would also occur for operating cost impacts, and excess capacity
6. Based upon the above comparative analyses of the alternatives, Alternative 4 has been identified as the preferred alternative.

Issues to be Resolved

All five alternatives analyzed herein, including the preferred alternative (Alternative 4), include 3 nm no-transit zones around principal rookeries for the Steller sea lion. Many such rookeries occur in State of Alaska waters. No-transit zones have the effect of closing some Alaska State waters to directed fishing for groundfish. Further, questions have arisen as to the use of federal fisheries permits, and the practice of returning them to NMFS to enable fishing in State waters, and then the re-applications for such permits, all possibly occurring several times in a given year. The legal and policy implications of such practices, and their effect on State-managed waters, must be more thoroughly addressed and understood in implementing the preferred alternative. Several options for implementation are being developed; further, the implications of the options must be considered in relation to the “no jeopardy and adverse modification” opinion of NMFS in their Draft Section 7 Consultation under the Endangered Species Act (Appendix A). NMFS will work with the State of Alaska to satisfactorily resolve these implementation issues prior to issuance of the final Supplemental Environmental Impact Statement (SEIS).

A second unresolved issue is related to experimental research programs and their design, and the conducting of broad-scale monitoring programs. An on-going experimental program which began in the late 1990s is testing the efficacy of no-trawl zones in relation to the possible effects of fishing on prey abundance and distribution relative to the Steller sea lion. A study at Sequam Island is addressing Atka mackerel issues, and a second study at Chiniak Island near Kodiak Island is addressing pollock biology. Both studies are designed to determine whether fisheries result in localized depletion of the target fish, and if so, whether or not Steller sea lions may be compromised because of the depletion of prey.

Relative to experimental programs specifically associated with Alternative 4, the Council has contracted with a four-person international team of scientists to review the NMFS 2000 Biological Opinion regarding its underlying scientific information, assumptions, and hypotheses. One specific task is to recommend an appropriate experimental design to improve the current understanding of the interactions between fisheries and Steller sea lions, and the efficacy of imposed management measures to promote recovery of the Steller

sea lion population. The final report from the team is due September 1, 2001. The team will continue to meet during the fall as an experimental design and related monitoring program is developed for the preferred alternative. The Council's Science and Statistical Committee (SSC) has indicated that an adequate experimental design can be developed within the context of the preferred alternative. The SSC noted that the design must follow solid scientific principles, including testable hypotheses and the evaluation of assumptions. Further, the design should include the power to detect differences in trends.

In addition to the experimental programs that NMFS is conducting, other agencies' and universities' research projects are being funded to examine various facets of Steller sea lion ecology and possible causes of the decline in populations. Numerous research programs are described in the August 2001 Draft Biological Opinion and Incidental Take Statement for Alternative 4. Over time, it is anticipated that these research findings will contribute to an increased understanding of Steller sea lion biology and the effectiveness of the management measures included in the preferred alternative.

Finally, as noted earlier, reasonable and prudent monitoring measures which are non-discretionary are included in the August 2001 Draft Biological Opinion and Incidental Take Statement. Specifically, the following measures are required to minimize the impacts from fisheries on the Steller sea lions:

1. Monitor the take of Steller sea lions incidental to the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) groundfish fisheries. (NMFS shall obtain counts of all Steller sea lions taken in the BSAI and GOA groundfish fisheries through its observer program. The observer program methods must be statistically robust enough to ensure that the direct take of Steller sea lions is accurately enumerated.)
2. Monitor all groundfish landings. (Monitoring of groundfish landings shall be sufficient enough to provide inseason managers with the appropriate information to determine if critical habitat harvest limits are exceeded. This information should also be sufficient to determine appropriate closures by sector, gear type, or region as necessary.)
3. Monitor the location of all groundfish catch to determine whether the catch was taken inside critical habitat or outside of critical habitat in the BSAI or GOA. (Monitoring of the location of groundfish catch shall be sufficient to provide inseason managers with statistically valid estimates of catch inside critical habitat and catch outside critical habitat by NMFS management area. This information must be robust enough to ensure that critical habitat harvest limits for Atka mackerel, Pacific cod, or pollock are not exceeded in a manner inconsistent with the objective for a dispersed fishery.)
4. Monitor vessels fishing for groundfish inside specified closed areas for pollock, Pacific cod, and Atka mackerel to determine if they are directed fishing for those species. (Monitoring of vessel location while directed fishing shall be sufficient to ensure that any vessel engaged in illegal activity, within a closure area for the conservation of Steller sea lions, is detected and appropriate action taken against the operators of that vessel.)

In summary, regarding the second unresolved issue, specific plans still need to be developed for experimental programs and broad-scale monitoring of the preferred alternative. It is expected that they will be included in the final SEIS on protection measures for the Steller sea lions.

Table ES-1 Crosswalk of management measures under the alternatives.

<u>Management Measures</u>	<u>Alternative 1 No Action</u>	<u>Alternative 2 Low and Slow Approach</u>	<u>Alternative 3 Restricted and Closed Areas</u>	<u>Alternative 4 Area and Fishery Specific Approach</u>	<u>Alternative 5 CH Catch Limit Approach</u>
Control Rule	Amendment 56 Tiers	TAC set as a % of maximum ABC	NMFS 2000 Biological Opinion Global Control Rule	RPA Comm. Global Control Rule	Amendment 56 Tiers
No Transit Zones	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries	3 nm no-transit zones around principal rookeries
Area Closures	No trawling 10/20 nm from 37 rookeries	Prohibit all trawling in CH/RFRPA; AI closed to pollock fishing	All CH/RFRPA sites designated as restricted or closed to fishing for pollock, cod, and mackerel	Specified closures by fishery, area, and gear type; areas 4, 9, and Segum closed to fishing for pollock, cod, and mackerel	No pollock fishing in AI area; no trawling 10/20 nm from 37 rookeries
Season Closures	No trawling 1/1 to 1/20	No trawling 1/1to 1/20; no trawling for pollock 11/1 to 1/20	No trawling 1/1 to 1/20; no trawling for pollock, cod, or mackerel 11/1 to 1/20; no fishing for pollock, cod, or mackerel inside CH 11/1 to 1/20	No trawling 1/1to 1/20; closure period between GOA pollock seasons; no trawling for pollock or cod 11/1 to 12/31	No trawling 1/1 to 1/20; no trawling for pollock 11/1 to 1/20
Seasons and Apportionments pollock	BSAI - 1/20 (45%), 9/1 (55%); GOA - 1/20 to 4/1 (25%), 6/1 to 7/1 (35%), 9/1 to 12/31 (40%)	Four seasons evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	AI - 1/20 (100%); BS 1/20 (40%), 6/11 (60%); GOA - 1/20 to 2/25 (25%); 3/10 to 5/31 (25%), 9/1 to 9/15 (25%), 10/1 to 11/1 (25%)	BSAI - 1/20, 4/1 (40%), 6/10, 8/20 to 11/1 (60%); GOA - 1/20 to 3/1 (30%), 3/15 to 6/1 (15%); 8/20 to 9/15 (30%), 10/1 to 11/1 (25%)

Table EC-1 Crosswalk of management measures under the alternatives (cont.).

<u>Management Measures</u>	<u>Alternative 1 No Action</u>	<u>Alternative 2 Low and Slow Approach</u>	<u>Alternative 3 Restricted and Closed Areas</u>	<u>Alternative 4 Area and Fishery Specific Approach</u>	<u>Alternative 5 CH Catch Limit Approach</u>
Seasons and Apportionments cod	BSAI trawl - 1/20 BSAI fixed -1/1, 5/1, 9/1 GOA trawl -1/20 GOA fixed - 1/1	Four seasons evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	BSAI trawl - 1/20 (80%), 6/11 (20%) BSAI longline- 1/1 (60%), 6/11 (40%) BSAI pot - 1/1 (60%), 9/1 (40%) GOA trawl - 1/20 (60%), 9/1 (40%) GOA fixed - 1/1 (60%), 9/1 (40%)	<u>BS trawl + fixed</u> - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%) <u>AI trawl + fixed</u> - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%) <u>GOA trawl + fixed</u> - 1/20 to 4/30 (40%), 5/1 to 11/1 (60%)
Seasons and Apportionments mackerel	AI - 1/20 to 4/15 (50%), 9/1 to 10/31 (50%)	Four season evenly distributed over year with 25% of TAC each season	BSAI - 1/20 (40%), 6/11 (60%); GOA - 1/20 (40%), 6/11 (60%)	AI - 1/20 to 4/15 (50%), 9/1 to 10/31 (50%)	AI - 1/20 to 4/15 (50%), 9/1 to 10/31 (50%)
Catch Limits Inside CH	Akta mackerel: incremental change to limit of 40% inside CH in 2002	Foraging area catch limits for fixed gear fishing for Pacific cod	Pollock, cod, and mackerel: 4 seasons (1/20, 4/1, 5/11 8/22) inside CH/RFRPA with catch limits based on season and area specific biomass estimates	SCA pollock 75% of A season harvest prior to April 1 Mackerel 70% inside 30% outside of each season apportionment GOA cod: option for AMCC zonal approach for GOA Pacific cod.	<u>Mackerel</u> : incremental change to 40% inside CH and 60% outside in 2002 <u>BSAI Pollock</u> : maximum TAC % allowed inside CH/RFRPA sites = 20% in A+B season combined (15% for A + B singly), 4.5% in C season and 7.5% in D season <u>BS cod</u> : maximum TAC % allowed inside CH = 20%

Table EC-1 Crosswalk of management measures under the alternatives (cont.).

<u>Management Measures</u>	<u>Alternative 1 No Action</u>	<u>Alternative 2 Low and Slow Approach</u>	<u>Alternative 3 Restricted and Closed Areas</u>	<u>Alternative 4 Area and Fishery Specific Approach</u>	<u>Alternative 5 CH Catch Limit Approach</u>
					(A), 3.6% (B) <u>AI cod</u> : maximum TAC % allowed inside CH = 20% (A), 48.3% (B) <u>GOA cod</u> : maximum TAC % allowed inside CH = 20% (A), 31.8% (B season)
Other Catch Limits		Daily catch limits: BS pollock 5000 mt GOA pollock 1000 mt BSAI cod 600 mt GOA cod 400 mt BSAI mackerel 300 mt			
Experimental Design	Small scale: Kodiak and Seguam localized depletion testing	Small scale with well defined and manageable objectives	Large scale: 4 sets of restricted/closed areas for comparison	Small scale with well defined and manageable objectives	Small scale: Kodiak and Seguam localized depletion testing
Observer Coverage	No change to current observer coverage requirements	No change to current observer coverage requirements	No change to current observer coverage requirements	No change to current observer coverage requirements	No change to current observer coverage requirements
VMS	Required BSAI Atka mackerel fishery				Required BSAI Atka mackerel fishery
Registration Requirements	None	Seasonal exclusive area registration	None		None

Table ES-2 Summary of effect of Alternatives 1 through 5 on each resource and impact parameter evaluated.

Steller Sea Lions	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Incidental take/entanglement in marine debris					
Harvest of prey species	CS-	CS+		CS-	CS-
Spatial/temporal concentration of fishery	CS-	CS+	CS+		
Disturbance					
ESA Listed Cetaceans					
Incidental take/entanglement in marine debris					
Harvest of prey species		(CS+ for humpbk whales)	(CS+ for humpbk whales)		
Spatial/temporal concentration of fishery					
Disturbance					
Unlisted Cetaceans					
Incidental take/entanglement in marine debris	(U for killer whales)	(U for killer whales)	(U for killer whales)	(U for killer whales)	(U for killer whales)
Harvest of prey species					
Spatial/temporal concentration of fishery					
Disturbance					
Northern Fur Seals					
Incidental take/entanglement in marine debris					
Harvest of prey species	CS-	CS-	CS-	CS-	CS-
Spatial/temporal concentration of fishery	CS-	CS-	CS-	CS-	CS-
Disturbance	U	U	U	U	U

Harbor Seals	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Incidental take/entanglement in marine debris					
Harvest of prey species	CS-	CS+		CS-	
Spatial/temporal concentration of fishery	CS-	CS+	CS-	CS-	CS-
Disturbance					
Other Pinnipeds					
Incidental take/entanglement in marine debris					
Harvest of prey species					
Spatial/temporal concentration of fishery					
Disturbance					
Sea Otters					
Incidental take/entanglement in marine debris					
Harvest of prey species					
Spatial/temporal concentration of fishery					
Disturbance					
EBS Pollock					
Fishing mortality					
Spatial temporal concentration of catch					
Change in prey availability					
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.					

Table ES-2 Summary of effect of Alternatives 1 through 5 on each resource and impact parameter evaluated.

GOA Pollock	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I
EBS Pacific Cod					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I
GOA Pacific Cod					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I
BSAI Atka Mackerel					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I
GOA Atka Mackerel	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Fishing mortality	U	U	U	U	U
Spatial temporal concentration of catch	U	U	U	U	U
Change in prey availability	U	U	U	U	U
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	U	U	U	U	U
BSAI/GOA Flatfish Target Species					
Fishing mortality	I	I	I	I	I
Spatial/temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability, change in suitability of spawning, nursery, settlement, etc, habitat	I	I	I	I	I
BSAI/GOA Other Flatfish Species					
Fishing mortality	U	U	U	U	U
Spatial/temporal concentration of catch	U	U	U	U	U
Change in prey availability	U	U	U	U	U
Habitat suitability, change in suitability of spawning, nursery, settlement, etc, habitat	U	U	U	U	U
BSAI Pacific Ocean Perch					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I

Table ES-2 Summary of effect of Alternatives 1 through 5 on each resource and impact parameter evaluated.

Other BSAI Red Rockfish and Other Rockfish	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	U	U	U	U	U
Change in prey availability	U	U	U	U	U
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	U	U	U	U	U
GOA Rockfish					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	U	U	U	U	U
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	U	U	U	U	U
GOA Thornyheads					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I
GOA Sablefish					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I

BSAI Squid and Other Species	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Squid	U/U	U/U	U/U	U/U	U/U
Skates	U/I	U/I	U/I	U/I	U/I
Sculpins	U/I	U/I	U/I	U/I	U/I
Sharks	U/U	U/U	U/U	U/U	U/U
Octopi	U/U	U/U	U/U	U/U	U/U
GOA Squid and Other Species					
Squid	U/U	U/U	U/U	U/U	U/U
Skates	U/U	U/U	U/U	U/U	U/U
Sculpins	U/I	U/I	U/I	U/I	U/I
Sharks	U/I	U/I	U/I	U/I	U/I
Octopi	U/U	U/U	U/U	U/U	U/U
BSAI Non-specified Species					
Grenadiers	U/I	U/U	U/I	U/I	U/I
Other Non-specified Species	U/I	U/U	U/I	U/I	U/I
Jellyfish	U/I	U/CS+	U/CS+	U/I	U/I
Sessile Invertebrates	U/I	U/U	U/I	U/I	U/I
Mobile Invertebrates	U/I	U/U	U/I	U/I	U/I
Total non-specified	U/I	U/U	U/I	U/I	U/I
GOA Non-specified Species					
Grenadiers	U/I	U/I	U/I	U/I	U/I
Other Non-specified Species	U/I	U/CS+	U/I	U/I	U/I
Jellyfish	U/I	U/S+	U/CS+	U/I	U/I
Sessile Invertebrates	U/I	U/CS+	U/I	U/I	U/I
Mobile Invertebrates	U/I	U/CS+	U/I	U/I	U/I
Total non-specified	U/I	U/CS+	U/I	U/I	U/I
Forage Fish / Area					
Smelt / BSAI	I/I	I/CS+	I/I	I/I	I/I
Other Forage Fish / BSAI	I/I	I/I	I/I	I/I	I/I
Smelt / GOA	I/I	I/CS+	I/S+	I/I	I/I
Other Forage Fish GOA	I/I	I/I	I/I	I/I	I/I

Table ES-2 Summary of effect of Alternatives 1 through 5 on each resource and impact parameter evaluated.

BS Prohibited Species Bycatch (Pollock and Pacific Cod)	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Halibut					
Herring		CS-			
Chinook Salmon		CS+			
Other Salmon		CS+			
Red King Crab					
Tanner Crab					
Other Tanner Crab					
Other King Crab		CS-			
Spatial Temporal Concentration of Bycatch - BSAI All Species					
Prey Competition					
AI Prohibited Species Bycatch (Atka Mackerel)					
Halibut					
Herring		CS+	CS+		
Chinook Salmon	CS+	CS+	CS-	CS+	CS+
Other Salmon					
Red King Crab					
Tanner Crab					
Other Tanner Crab		CS+	CS+	CS+	
Other King Crab					
Spatial Temporal Concentration of Bycatch - BSAI All Species					
Prey Competition					
GOA Prohibited Species Bycatch	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Halibut					
Herring					
Chinook Salmon					
Other Salmon					
Red King Crab					
Tanner Crab					
Other Tanner Crab					
Other King Crab					
Spatial Temporal Concentration of Bycatch - BSAI All Species					
Prey Competition					
ESA Listed Pacific Salmon					
Bycatch - BSAI		CS+			
Bycatch - GOA		CS+			
Spatial Temporal Concentration of Bycatch - BSAI					
Spatial Temporal Concentration of Bycatch - GOA		CS+			
Prey Competition					
Northern Fulmar					
Incidental take–BSAI	U		U	U	U
Incidental take–GOA					
Prey availability					
Benthic habitat					
Proc. waste & offal	CS+		CS+	CS+	CS+
Short-tailed Albatross					
Incidental take	CS-	CS-	CS-	CS-	CS-
Prey Availability					
Benthic Habitat					
Proc. Waste & Offal					

Table ES-2 Summary of effect of Alternatives 1 through 5 on each resource and impact parameter evaluated.

Other Albatrosses & Shearwaters	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Incidental Take					
Prey Availability					
Benthic Habitat					
Proc. Waste & Offal					
Piscivorous Seabirds (Also Breeding in Alaska)					
Incidental Take					
Prey Availability	U	U	U	U	U
Benthic Habitat					
Proc. Waste & Offal					
Eiders (Spectacled and Stellers)					
Incidental Take					
Prey Availability					
Benthic Habitat					
Proc. Waste & Offal					

Other Seabird Species	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Incidental Take					
Prey Availability					
Benthic Habitat					
Proc. Waste & Offal					
Marine Benthic Habitat					
Removal and damage to HAPC biota	CS-	S+	CS+	CS-	CS-
Removal and damage to HAPC biota	CS-	CS+		CS-	CS-
Modification of nonliving substrates, damage to epifauna and infauna by trawl gear	CS-	CS+	CS+	CS-	CS-
Modification of nonliving substrates,					
Changes to species mix	CS-	CS+	CS+	CS-	CS-
Predator-prey Relationships					
Pelagic Forage Availability	S+	S+	S+	S+	S+
Spatial and Temporal Concentration	CS-	CS+	CS+	CS+	CS+
Removal of Top Predators					
Introduction of Nonnative Species	CS-				
Energy Flow and Balance					
Energy Redirection (Discards)					
Energy Removal (Catch)					
Diversity					
Species Diversity	CS-	CS+	CS+	CS+	CS+
Functional (Trophic) Diversity					

Table ES-2 Summary of effect of Alternatives 1 through 5 on each resource and impact parameter evaluated.

Economic Indicators	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Existence Values	CS-	CS+	CS+	CS+	CS+
Non-market Subsistence Use	CS-	CS+	CS+	CS+	CS+
Non-consumptive Eco-tourism Use	CS-	CS+	CS+	CS+	CS+
Harvests & Fish Prices	CS+	S-	S-	I	CS-
Operating Cost Impacts	CS+	CS-	CS-	CS-	CS-
Groundfish Product Values	CS+	S-	CS-	S-	CS-
Safety Impacts	CS-	CS-	CS-	CS-	CS-
Impacts on Related Fisheries	U	U	U	U	U
Costs to Consumers	CS+	CS-	CS-	I	I
Management and Enforcement	I	S-	S-	S-	S-
Excess Capacity	CS-	U	U	U	U

Table ES-3 Comparisons of Alternatives 1, 2 and 4 using four socioeconomic indicators.

		Reduction between Alternative 1 and Alternative 2				Reduction between Alternative 1 and Alternative 4			
Indicator		Tons of CV harvest	Ex-Vessel value	Payments to Labor	Employment (FTEs)	Tons Harvest	Ex-Vessel value	Payments to Labor	Employment(FTEs)
ALL	loss	343 - 615K	88 - 149M	185 - 309M	2,923 - 4,740	51 - 100K	2.6 - 14.4M	7.1 - 33M	34 - 513
	%	31 - 55	36 - 61	28 - 47	29 - 48	5 - 9	1 - 6	1 - 5	0 - 5
Alaska Pen. & Aleutian Islands	loss	7.0 - 10.2K	70 - 123M	54 - 96M	1,250 - 2,218	0.9 - 2.2K	1.7 - 10M	1.4 - 7.8M	30 - 184
	%	54 - 80	34 - 60	33 - 60	33 - 60	7 - 17	1 - 5	1 - 5	1 - 5
Kodiak	loss	26.6 - 43.1K	15.6 - 22.1M	15.0 - 21.8M	335 - 478	(-0.3) - 5.0K	1 - 3.8M	0.5 - 3.4M	1 - 73
	%	41 - 67	50 - 71	45 - 67	45 - 64	0 - 8	3 - 12	1 - 10	0 - 10
Alaska Southcentral	loss	3.5 - 5.0K	1.3 - 1.6M	2.7 - 3.7M	44 - 60	(-0.4) - 0.7K	(-44) - 145K	(-0.2) - 0.4M	(-10) - 4
	%	39 - 55	40 - 49	30 - 42	27 - 37	(-4) - 8	(-3) - 4	(-2) - 5	(-6) - 2
Alaska Southeast	loss	2.7 - 3.3K	1.7 - 2.9M	2.9 - 4.7M	50 - 68	(-0.1) - 0.5K	4 - 400K	(-20) - 739K	(-2) - 9
	%	39 - 47	25 - 42	23 - 38	28 - 38	(-2) - 7	0 - 6	0 - 6	(-1) - 5
Washington Inland Waters	loss	245 - 451K	N.A.	102 - 168M	1,116 - 1,725	37 - 69K	N.A.	3.8 - 17.9	0 - 201
	%	28 - 53	N.A.	24 - 41	24 - 37	4 - 8	N.A.	1 - 4	0 - 4
Oregon Coast	loss	38 - 66K	N.A.	4.9 - 8.3M	56 - 91	9.6 - 14.8K	N.A.	1.3 - 1.9M	14 - 23
	%	37 - 65	N.A.	39 - 67	41 - 67	9 - 15	N.A.	10 - 15	10 - 17

Note: (-) denotes a negative loss, that is, an increase in that indicator relative to Alternative 1. N.A. (not applicable) is used because little or no pollock, Pacific cod or Atka mackerel caught off Alaska is delivered to shorebased processors in Washington or Oregon.